

RULE 26 REPORT
OF
PETER R. LEFFE

I, Peter R. Leffe, BsMe, M.Arch, ATP, do hereby swear, testify, declare, and affirm as follows:

I was retained by Hermann Law Group of Seattle, Washington as an Aviation Accident Investigator and potential expert witness in the field of Aviation Accident Investigation and Reconstruction. The case is the Estate of Joochan Lee v. Moody Bible College of Chicago. Originally, I was retained to review records and then examine the aircraft wreckage to identify any specific signatures on the wreckage. The purpose of this was to find any possible mechanical, electrical, design or overload fault(s) that could have caused the subject accident. As a retained expert and I was asked to provide a Federal Rule of Civil Procedure Rule 26 Report which outlines and detailed all the opinions I formed regarding the subject incident.

Qualifications:

I have extensive knowledge, education, experience, training and skill in the areas of Mechanical Engineering, aviation accident investigation, accident reconstruction, aircraft construction maintenance and repair which all provide reliable foundation for each of my opinions.

Regarding my education and training, I hold the degree of Bachelor of Science in Mechanical Engineering with Metallurgy from the Indiana Institute of Technology. I am qualified to evaluate various types of mechanical systems to determine how they were designed, how they work, how they are tested and how they fail. Also, as a result of this degree, I am readily familiar with different types of forces (i.e.: tensile, compressive, torsional force, etc.) and how said forces effect different types of materials and components within mechanical systems. Finally, I am qualified to read and understand design drawings, testing materials and reports pertaining to various aircraft systems.

I have also received formal training in the area of aircraft accident investigation through the School of Engineering at the University of Southern California. This course was designed and created based upon the United States Air Force aircraft accident investigation manual, which was written by the staff at the Air Force Inspection and Safety Center.

Furthermore, from the beginning of my work on this case through the present, I have applied the scientific methodology outlined in both the USC School of Engineering Aircraft Accident Investigation course materials and upon the United States Air Force aviation accident investigation manual, while investigating this accident.

Graduates of the USC course, such as myself, are educated and familiarized with all aspects of the investigation process, starting with preparation for investigation through report writing. Investigative techniques are examined with an emphasis on fixed wing investigation. Data collection, wreckage reconstruction and cause analysis are also studied. Finally, the course also covers the National Transportation Safety Board and International Civil Aviation Organization (ICAO) procedures. This course of study is compliant with ICAO Annex 13 training guidelines for aviation accident investigators and graduates of this program are qualified to conduct aviation accident investigation in 190 countries worldwide.

The USC course also offered detailed instruction in structural analysis, which provided detailed descriptions of various signatures found in wreckage and what each signature (i.e.: bend, scrape mark, burn, etc.) would indicate and why.

The USC course is highly relevant to this case because it provided me with the accepted scientific approach necessary to conduct an aircraft accident investigation utilizing the highest standards of accident investigation in the industry, those standards created by the United States Air Force and adopted internationally by ICAO. That, coupled with my Bachelor of Science in Mechanical Engineer provided me the requisite knowledge necessary to form opinions regarding the cause of the subject incident.

I am a member of the International Society of Air Safety Investigators (ISASI). ISASI is the worldwide association of professional aviation accident investigators. Membership requires qualification by review of ten crashes investigated by a potential new member. The society disseminates up to date information on the latest investigative techniques. I am currently under consideration for Life membership.

Additional cumulative education included the NTSB First Responder Training and Certification, FAA Aviation Safety Counselor program presenter, course by the European Society of Air Safety Investigators- Air Accident Investigation in the European Environmental, Cranfield University, Bedfordshire, England. I also hold the degree of Master of Architecture from the University of California at Berkeley. I was awarded a teaching fellowship in Structural Engineering for Architects and taught graduate level architecture students fundamental structural engineering analysis.

During the forty-four (54) years that I have been involved in the aviation field I qualified and hold an FAA Airframe and Engine Mechanics license which certified me to, inspect, repair and maintain aircraft.

In addition to my formal education, I have fifty-four (54) years of extensive experience and skill in the aviation industry, not only as an employee of an aircraft manufacturer, but also as a pilot, aircraft mechanic, designer and builder.

I obtained my student pilot license in 1966 and my private pilot license in 1968. I also hold a commercial pilot license, an instrument rating, and I am a licensed Airline Transport Pilot, the highest level of pilot licensure possible which allows me to act as a Captain of an aircraft carrying passengers for hire and to train other pilots for purpose of air commerce. I have over 3500 total flight hours with no violations, and I have never been reported to the FAA. I am also qualified in High Performance aircraft (aircraft with more than 200 HP) and qualified in Complex Aircraft (retractable landing gear and controllable pitch propeller). I am also tail wheel qualified with over 900 hours of flight with aircraft with a tail wheel. I have turbo prop and jet experience.

I have acted as a safety/instructor pilot for the United States Military via the U.S. Navy Test Pilot School in their Qualitative Evaluation Program, a safety pilot and flight engineer for the National Test Pilot School in their Qualitative Evaluation Program, and a safety/instructor pilot for the British Military via their Empire Test Pilot School Qualitative Evaluation Program. I am also an transition/instructor pilot for the Siai Marchetti SF-260 military aircraft. Finally, I am also an FAA Authorized advanced Instructor by virtue of my ATP rating.

I have extensive training in aerobatic maneuvering and specialized training in unusual attitude recovery techniques. These have provided me with specialized knowledge on how an aircraft would perform or react to flight control input that is either normally controlled, cross- controlled, rolling attitude, inverted attitude, stall and spin regimes. .

Between the years 1968 and 1969, I worked at McDonald Douglas Aircraft Corporation in Long Beach, California. During that time, I was gained experience with the aircraft industry standards for design, testing and construction of aircraft.

I have been involved in Aviation Accident Investigation for approximately 27 years. During that time, I estimate that I have investigated more than 150 aircraft accidents.

I have been admitted to testify in Federal Court as an expert in the field of Aviation Accident Investigation and Reconstruction on at least three (3) separate occasions.

INTRODUCTION:

From the NTSB Factual report.

On July 13, 2018, at 1021 Pacific daylight time, a Cessna 172R airplane, N24442, was substantially damaged when it was involved in an accident near Deer Park, Washington. The flight instructor and two student pilots were fatally injured. The airplane was operated as a Title 14 *Code of Federal Regulations* Part 141 instructional flight.

The purpose of the flight was for the student pilot to undergo flight instruction. This was the first flight in his training program and the student pilot who was seated in the rear seat was an observer. The flight departed from Felts Field Airport (SFF), Spokane, Washington about 0955, and the pilots intended to remain in the local area.

Following departure, the flight proceeded to the Clayton practice area located about 15 miles northwest of the airport.

A review of the radar track data indicated that, after entering the practice area at 1010, the airplane began a gradual 90° left turn and continued in a southwesterly direction, temporarily leaving the Clayton boundary. The airplane continued in a gradual climb to about 7,000 ft mean sea level (msl) and then made a 180° right turn. The flight track remained on a northeasterly heading until about 1018, at which point the airplane made another 180° left turn to a heading of 208°. The airplane proceeded about 2.5 miles at altitudes varying between about 7,000 to 7,450 ft msl. At 1020:53, the data indicated the airplane was at an altitude of 7,000 ft msl and an estimated ground speed of 77 knots. The airplane then made a sharp 90° right turn and continued on a 305° heading for about 14 seconds. The airplane then made another sharp 90° right turn, and the last recorded track data, at 1021:18, indicated an estimated ground speed of 117 knots.

The accident site was located about 740 ft southwest of the last recorded track data. Witnesses reported that the airplane banked hard, then descended in a steep dive toward terrain. During the descent, the wings departed the airplane before ground impact.

INVESTIGATION OF THE FLIGHT PATH OF THE ACCIDENT AIRCRAFT

My analysis of the flight path data from the NTSB report represents the flight path of a training aircraft on a first student flight. First, a gradual left 90 degree turn to the southwest. Followed by a 180 degree turn to the right on a northeasterly heading. Aircraft then made a 180 degree turn to the left. These turns and the altitude variations from 7,000 to 7,450 are all indicative of the plane being controlled by a student pilot.

Then the airplane made a sharp right 90 degree turn followed by another sharp 90 degree turn. These turns are indicative of control of the aircraft by the instructor pilot, not a student. The first of these turns occurred at a low airspeed of 77 knots which is below the maneuvering speed of the subject aircraft. Maneuvering speed is defined as the speed where the aircraft will stall before overstress of the airframe is possible. The second 90 degree turn occurred at 117 knots but not far above maneuvering speed and of short duration. This would not result in an aerodynamic overload of the airframe. These turns are suggestive of maneuvers to attempt to avoid a flock of birds encountered at altitude. An overload would result in the departure of an aerodynamic surface such as an elevator or wing section. We know from the work of the NTSB that the airframe experienced dynamic overloading in the dive that resulted from bird impact. Wing outer sections departed in the post bird contact dive, as ground witnesses reported. The wreckage, with the exception of the outer wing panels, was in a concentrated area. The wing panels were a few hundred feet away. Had aerodynamic overload conditions resulted in the dive those conditions would have been evident in the wreckage. No overload conditions were noted.

INVESTIGATION OF THE WRECKAGE:

Pursuant to the standard scientific methodology utilized by NTSB, ICAO and taught by the USC School of Engineering, I closely inspected all flight control cables for evidence of jamming, binding, and pre-impact failure. Pursuant to the manual and course, I looked for fore and aft markings on adjacent structures, which, according to this course and other standard practices say is indicative of jammed flight controls. Finally, and pursuant to the accepted scientific methodology of accident investigation, I looked for broken or disconnect fittings, which according to this course and other standard practices, if the failure occurred in flight and the surfaces were moved by air loads, you should see significant markings on adjacent structures. None were found.

In analyzed the wreckage I looked for various signatures, like bending, scrape marks, burns, etc. to determine what caused each of those signatures and how they explain what happened in this particular flight and accident.

Analysis rather than testing in this case provided a reliable basis for each of my conclusions regarding the cause of the any signature marks and/or bending found within the wreckage.

MAINTENACE REVIEW OF THE SUBJECT AIRCRAFT:

I completed a review of the maintenance records of the subject aircraft to rule out any maintenance issue.

ITEMS REVIEWED:

NTSB factual report

Cessna 172R Pilots Operating Handbook

507 pages of Maintenance records of Moody Bible College flight school maintenance department

Additional disclosure items from defendant such as pages from Airman's Information Manual (AIM) and other items identified as confidential

Cornell Bird Lab range maps of Great American Pelicans in the Spokane, Washington area

Personal knowledge of Pelican flight characteristics while flying in the Sea of Cortez area of Mexico

Airman's Information Manual regarding bird strikes, Section 5, 7-5-1, 7-5-2, 7-5-4, 7-5-5

Detailed wreckage inspection of the subject aircraft wreckage, including airframe and engine

Moody Bible College map of flight practice areas

Airport Flight Directory Page 225, Felts Field, Washington (KSFF)

OPINIONS:

After a review of the evidence using the accepted scientific methodology in investigating an aviation accident as taught by the USC course (developed by the United States Air Force and adopted by internationally by ICAO), I formed the following opinions regarding this accident.

It is my opinion that the flight school operated by Moody Bible College knew or should have known that there were large birds in the area that posed a significant danger to the safety of flight.

Basis for this opinion is the EBird internet site for the Deer Park, WA area for American White Pelicans and the Moody Bible College practice area map, Airman's Information Manual (FAA), Pilots Flight Manual for Cessna 172R aircraft, Airport Flight Directory.

The Airport Flight Directory alerts pilots of the presence of "waterfowl and birds on and in the vicinity of the airport". The EBird web site for the Deer Park area records many sightings of waterfowl, specifically Great American Pelicans in the area of flight operations. This information is easily accessible to the public and reference data available to anyone diligently discharging the duties of assuring the safety of flight operations.

It is my opinion that the subject flight school had a variety of alternative practice areas, and some are located in areas that might not be in bird prone areas.

Basis for this opinion is the Moody Bible College practice areas map, EBird Maps, FAA sectional chart of the subject area surrounding the Spokane area and my education, training and experience.

The practice area map used by Moody Bible College showed areas for flight operations well to the south and east of the pelican sightings which were to the northwest of Felts Field. These alternative areas could have been investigated for a lack of large migrating bird activity to assure safety if selected.

EBird maps which were available online could have allow the flight school to determine if any of its other areas were safe for use. As well FAA sectional charts could be used to determine if the topography was appropriate or if any obstructions could affect the safety of flight in any alternative area.

The flight school knew or should have known that the Great American Pelicans could be found at higher altitudes and that having their training planes fly at 5,000 feet AGL, 7,000 MSL provided no protection against bird strike.

Basis is the EBird sightings maps, Wikipedia information and other internet information of the Great American Pelican, Airport Flight Directory.

In reviewing bird activity in any potential area used for student practice the characteristics of the subject birds would be of importance. Once the presence of waterfowl was known and the type was determined their flight characteristics could be found by simple online search or consultation with the Fish and Game service in the area. Knowing the flight characteristics of the particular birds would be of great importance in accessing the safety of flight in an area or at a particular altitude.

It is my opinion that the flight school could have grounded its fleet until the birds moved out of their practice area(s).

Basis is my education, training and experience in the operation of flight training activities as used in for the U. S. Navy Test Pilots school and other flight training activities, flying with student/transition pilots, filming of a tv commercial.

In my experience assisting with training programs and commercials one option always available is to ground aircraft until safety of flight can be assured. Be it weather, obstructions, wildlife, smoke, other flight operations the safest fallback position is to ground aircraft.

It is my opinion that the cause of the crash was a bird strike.

Basis for this opinion is the NTSB factual report, my inspection of the aircraft wreckage, consultation with Dr. Banjac regarding the strength of the subject windshield, Pilots Flight Manual for the Cessna 17R aircraft, Airman's Information Manual and my education, training and experience.

The flight manual clearly outlines the consequences of a bird strike on the subject aircraft. A small hole could be plugged but with the collision with a large bird the impact force would more likely than not implode the entire windshield. It is clear that the aircraft could not maintain flight without the windshield. The total implosion of the windshield would more likely than not incapacitate the pilot and result in a loss of control of the aircraft.

The NTSB report clearly documents the bird strike with a Great American Pelican the second largest bird in North America. DNA was used to establish the type of bird and Dr. Banjac's calculations provide an understanding of the force exerted on the windshield of a single bird strike. It has been my experience observing pelicans in flight that they fly in formations to take advantage of "drafting" the leading bird. This fact could lead to a multiple bird strike or a strike at an oblique angle where the bird did not pass through the propeller and its full mass impacted the windshield.

It is my opinion upon a through physical inspection of the aircraft wreckage that there were no other probable cause(s) such as engine, propeller or control system failure that could have led or could to the crash and subsequent loss of life.

Basis of the formation of this opinion was my inspection of the aircraft wreckage the NTSB Factual Report, USC Aviation Accident Investigation training course and my general education, training and experience.

I inspected the engine or signatures associated with the catastrophic failure of the engine. The component parts, pistons, rings, cylinder wall, connecting rods, crankshaft, valves, etc., were all in excellent operational condition. As well, the loss of the engine would NOT result in a loss of control of the aircraft. The aircraft was capable of gliding approximately ten (10) miles from its flight altitude had it lost engine power.

I inspected the propeller which is a fixed pitch type with no moving parts. It was recovered in the wreckage pile and was not lost in flight.

I inspected the control cables of all flight controls. While the cables were broken those breaks could be associated with the loss of the outer sections of wing from exceeding the Vne (speed not to exceed) and Vdive (max speed in a dive equals Vne + 10%) of the aircraft.

I inspected the skin surfaces for signs of bending associated with overload failure in flight possibly due to the two ninety (90) degree turns but nothing was found.

I inspected other parts and systems as much as possible with nothing pointing to a control or structural failure other than the shattered windshield.

It is my opinion that the subject aircraft could not sustain flight after a bird strike that destroyed the windshield and/or incapacitated the instructor pilot.

Basis for this opinion was consultation with Dr. Banjac regarding the impact force of a Great American Pelican (even after passing through the propeller) upon the aircraft windshield and the force that it would impact a human body with.

The Flight manual for the aircraft clearly states that the performance of the Cessna 172R would be greatly reduced possibly requiring an off field landing but doesn't address the total loss of the windshield or the possibility of pilot incapacitation.

It is my opinion that the student in the front seat was not capable of taking over the control of the aircraft after a bird strike that incapacitated the instructor pilot

Basis for this opinion was my personal experience of 54 years of flying my flight training experience as a student and my experience with students. The person in the left front seat identified as Mr. Lee, did not even hold a student pilot's license. Said student license is issued after a physical examination and the student solos the aircraft. At that point they are awarded their student pilot license.

The left seat student more likely than not was incapacitated at the same time as the instructor pilot. The total loss of the windshield rendered the plane uncontrollable due to the massive drag induced.

It is my opinion that a bird or part of a bird coming through the windshield could have incapacitated or killed the instructor pilot who was the only person in the aircraft capable of flying the aircraft.

Basis for this opinion is my consultation with Dr. Banjac, my experience as a student and student pilot, the NTSB report, Flight path data.

In consultation with Dr. Banjac his calculations indicated that the force of a bird strike by a Great American Pelican would more likely than not collapse the windshield inward as a large mass. The forces on the windshield would be of such a magnitude that they could kill a person impacted by such force.

It is my opinion that the flight school through its chief pilot is responsible for reviewing any and all local conditions that might have an effect on the safety of flight. Such review should have led to the use of alternative flight areas or grounding of the fleet.

Basis for this opinion is my knowledge and experience with flight operations for the U.S. Navy Qualitative Evaluation Program and other similar programs, involvement with the filming of commercials using aircraft, knowledge and understanding of flight school operations and Federal Air Regulations.

The fact that waterfowl were present in the area was known for Felts Field and the Deer Park area. Due diligence would have led a person responsible for the safety of flight operations to review all data effecting the safety of flight. This data was easily obtainable and readily available. The local fish and wildlife service could have been consulted for the present of large birds in the area. The subject pelicans were a normal occurrence in the Deer Park area and the sightings were a clear sign that alternatives to normal flight operations needed to be taken to assure the safety of flight.

I declare under penalty of perjury, that the above is true and correct to the best of my knowledge.

Dated: September 4, 2021

Signed: 

Peter R. Leffe, Mechanical Engineer